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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/656,898	09/05/2003	Alexander Star	NANOP002/NMX-043.2	1540

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EXAMINER	
RAO, SHRINIVAS H	

ART UNIT	PAPER NUMBER
2814	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/656,898	STAR ET AL.	
	Examiner	Art Unit	
	STEVEN H. RAO	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 June 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 19-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-10 and 19-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/17/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on June17, 2008 has been entered and forwarded to the Examiner on July 13, 2008.

Therefore claims 1,20, 21 as amended by the amendment and claims 2-10, and 19 as previously recited and presently newly added claims 22 to 25 are currently pending in the Application.

Claims 11 to 18 were previously cancelled.

Information Disclosure Statement

The IDS filed on June 17, 2008 has been considered and the initialed PTo-1449 made part of the E-Red folder.

Content of Specification

Applicant is required to provide with the next response a list of all Applications by the same inventors and inventions subject to assignment to the same entity at the time of the invention relating to the to the same matter and further cite any herein by a IDS any references pertinent to instant application any references cited in these applications See 37 CFR 1.56 etc,

This is a second request, Applicants' continued future failure if any to comply with this requirement may result in the amendment or filing being not entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.
Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere* Co., 383 U.S. 1,148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-9, 11, 19 to 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai (U.S. Patent No. 6,528,020, herein after Dai), previously applied and in view of the Article " Polymer Fictionalization of Air-Stable n-Type Carbon Nanotube Field-Effect Transistors by Moonsub Shim et al., J. AM. Chem. Soc., 123 , (published on web 10/30/2001), 2001. (herein after Shim et al.) presently newly applied.

With respect to claim 1 Dai describes a nanostructure sensor for sensing a target species, (figs. 2,6 etc.) comprising:

Dai does not categorize its device as having n-type or p-type characteristics.

However , Shim et al. reference in page 11512 right hand col. 3 full para describes a device having n-type FET characteristics to provide air stable n-type FETs and to provide FETs operable over a wider range.

The remaining limitations of claim 1 are :

device comprising at least one molecular nanostructure the nanostructure comprising at least one carbon nanotube (Dai 20, Shim – SWNT) ; at least two conducting elements (Dai 23, Shim-FETs) in electrical communication with the at least one nanostructure (Dai 23 in communication with 20)

so as to define a conduction path including the at least one nanotube;

The recitation "so as to define a conduction path including the at least one nanotube" is taken to be not a positive limitation but only requires the ability to so

perform. This recitation does not constitute a limitation in any patentable sense and therefore cannot be given patentable weight.

a gate electrode disposed (Dai col.2 line 34, etc. Shim-FET) and configured to apply a selectable voltage, wherein application of a selectable voltage influences a conductivity of the at least one nanotube;

The recitation, "configured to apply a selectable voltage so as to electrically influence a conductivity of the at least one nanotube" a gate electrode disposed and configured to apply a selectable voltage so as to electrically influence a conductivity of the at least one nanotube;" is taken to be not a positive limitation but only requires the ability to so perform. This recitation does not constitute a limitation in any patentable sense and therefore cannot be given patentable weight.

.

a polymer layer adsorbed on the at least one nanostructure, wherein the adsorbed layer alters the electrical properties of the at least one nanotube from response to application of a gate voltage (Shim fig.1 and page 11512 right hand column).

With respect to claim 2 Dai describes the nanostructure sensor of Claim I, wherein the at least one nanostructure is selected from the group consisting of nano tubes, nano wires, nano fibers, and nano rods. (Dai col.4 lines 23-30, Shim – SWNT).

With respect to claim 3, Dai describes the nanostructure sensor of Claim I, wherein the at least one nanostructure comprises a single-wall carbon nanotube. (Dai col.4 lines 1-

10, Shim-I st paragraph).

With respect to claim 4 Dai describes the nanostructure sensor of Claim I, wherein the at least two conducting elements comprise metal electrodes. (Dai col.4 lines 23-40) .

With respect to claim 5 Dai describes the nanostructure sensor of Claim I, wherein the at least two conducting elements are in direct physical contact with the at least one nanostructure. (Dai fig.2, col. 4 lines 35-40).

With respect to claim 6 Dai describes the nanostructure sensor of Claim 1, wherein the polymer layer is selected to interact with the target species. (Dai col. 5 lines 43-50, col. 6 lines 5-11, Shim fig. 2 pp. 11513 left hand col.)

With respect to claim 7 Dai describes the nanostructure sensor of Claim I, wherein the polymer layer on the at least one nanostructure is discontinuous. (Dai col. 2 lines 28 – 30).

With respect to claim 8, Dai describes the nanostructure sensor of Claim I, wherein the polymer layer comprises more than one material. (Dai col.2 lines 28-30, Shim –PEI coating).

With respect to claim 9, Dai describes the nanostructure sensor of Claim I, wherein the target species comprises ammonia (Shim pp. 11512 right hand col. Last 5 lines) and the polymer layer comprises polyethylimine. (Shim PEI).

With respect to claim 19 Dai describes the nanostructure sensor of Claim I, wherein the at least one molecular nanostructure comprises one or more structures selected from the group consisting of nanotubes, nanorods, nanofibers or nanowires. (Dai figs. 1C and 3 B, col. 4 lines 41-57).

With respect to claim 20 Dai describes the nanostructure sensor of Claim 1, wherein the polymer layer comprises a material providing an increase in response of the sensor to at least the target species. (Dai col. 5 lines 43-50, col. 6 lines 5-11, Shim fig. 2 pp. 11513 left hand col.) .

With respect to claim 21 Dai describes the nanostructure sensor of Claim I, wherein the conduction path includes a plurality of carbon nanotubes. (Dai col. 4 lines 41-57)

With respect to claim 22, Dai describes the nanostructure sensor of claim 1 wherein passivation material (Dai fig. 1a, 14) covering at least regions in which there is electrical communication between the at least two conducting elements (17) and the at least one nanostructure. (17 in electrical communication with CMOS or BI-CMOS not shown in figures , but described in col. 4 lines 22-29).

With respect to claim 23, Dai describes the nanostructure sensor of claim 1 wherein the polymer layer is less than 10 nm thick. (Shim pp. 11513 left hand column thin monolayer of molecular scale i.e "very thin coating" , equated by Applicants' to be about 10 nm thick- applicants' remarks of 6/17/2008page 8 first paragraph) .

With respect to claim 24, Dai describes a nanostructure sensor (Dai figs. 2, 6) for sensing ammonia target species (Dai fig.4) .

Dai does not categorize its device as having n-type or p-type characteristics.

However , Shim et al. reference in page 11512 right hand col. 3 full para describes a device having n-type FET characteristics to provide air stable n-type FETs and to provide FETs operable over a wider range.

The remaining limitations of claim 24 :

at least one molecular nanostructure, the nanostructure comprising at least one carbon nanotube (Dai 20, Shim – SWNT); at least two conducting elements(Dai 23, Shim-FETs) in electrical communication with the at least one nanostructure (Dai 23 in communication with 20) .

The recitation "so as to define a conduction path including the at least one nanotube" is taken to be not a positive limitation but only requires the ability to so perform. This recitation does not constitute a limitation in any patentable sense and therefore cannot be given patentable weight.

a gate electrode disposed (Dai col.2 line 34, etc. Shim-FET)
and configured to apply a selectable voltage, wherein application of a selectable voltage electrically influences a conductivity of the at least one nanotube; and a polymer layer comprising polyethylimine adsorbed on the at least one nanostructure,(Shim fig.1 and page 11512 right hand column). said polymer layer configured to interact with the ammonia target species. (Dai col. 5 lines 43-50, col. 6 lines 5-11, Shim fig. 2 pp. 11513 left hand col.)

B . Claims 10 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai (USPN 6,528,020) and Shim as applied to claim 1 above, and further in view of McGill (USPN 6,320,295, herein after McGill).

With respect to claim 10, Dai teaches all the limitations as stated above.
Dai and Shim do not specifically teach that the target species comprises hydrogen -

although, hydrogen is a well-known target for CNT sensors (see ref. [V], p.237, fig. 14)- and the polymer layer is polyethyleneimine (PEI).

However, McGill, drawn to chemical sensors, does teach, from column 7, lines 15-19, the use of PEI as a hydrogen sensor.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of invention, to have Dai's nanostructure sensor device use PEI as the polymer over-layer since this material was known to detect hydrogen as disclosed by McGill, and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With respect to claim 25, Dai describes a nanostructure sensor.

Dai and Shim do not specifically mention for sensing hydrogen target species. although, hydrogen is a well-known target for CNT sensors (see ref. [V], p.237, fig. 14)- and the polymer layer is polyethyleneimine (PEI).

However, McGill, drawn to chemical sensors, does teach, from column 7, lines 15-19, the use of PEI as a hydrogen sensor.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of invention, to have Dai's nanostructure sensor device use PEI as the polymer over-layer since this material was known to detect hydrogen as

disclosed by McGill, and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

The remaining limitations of claim 25 are :

an n-type carbon nanotube field effect transistor,

Dai does not categorize its device as having n-type or p-type characteristics.

However , Shim et al. reference in page 11512 right hand col. 3 full para describes a device having n-type FET characteristics to provide air stable n-type FETs and to provide FETs operable over a wider range.

The remaining limitations of claim 25 :

at least one molecular nanostructure, the nanostructure comprising at least one carbon nanotube (Dai 20, Shim – SWNT); at least two conducting elements(Dai 23, Shim-FETs) in electrical communication with the at least one nanostructure (Dai 23 in communication with 20) .

The recitation "so as to define a conduction path including the at least one nanotube" is taken to be not a positive limitation but only requires the ability to so perform. This recitation does not constitute a limitation in any patentable sense and therefore cannot be given patentable weight.

The remaining limitations of claim 25 are :

a gate electrode disposed (Dai col.2 line 34, etc. Shim-FET)

and configured to apply a selectable voltage, wherein application of a selectable voltage electrically influences a conductivity of the at least one nanotube; and a polymer layer comprising polyethylimine adsorbed on the at least one nanostructure,(Shim fig.1 and page 11512 right hand column) said polymer layer configured to interact with the hydrogen target species. (McGill col. 7 lines 15-17, etc.).

Response to Arguments

Applicants' first contention that the previously applied prior art does not disclose " the polymer layer alters the electrical properties of the at least one nanotube from p-type to n-type response to the application of gate voltage" is moot in view of applied Shim reference.

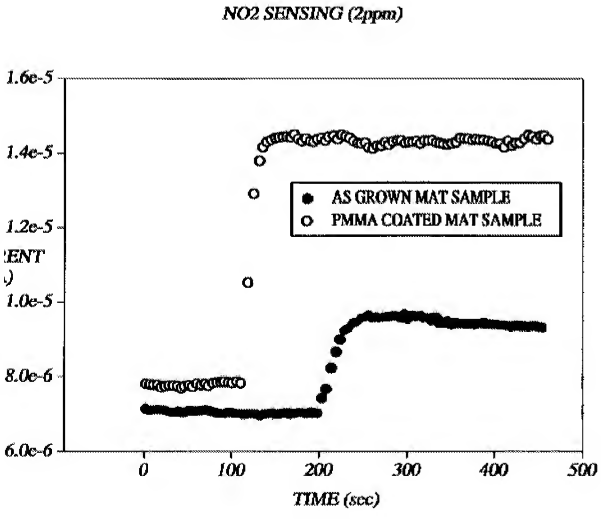
Applicants' arguments w.r.t other limitations that are functional, the limitations have been given patentable weight to the extent possible, but those that are functional cannot be considered.

Applicants' next contention that they cannot find no case law or MPEP that requires Applicants' to recite their functional limitations in proper format, their attention is drawn to In re Fuller, 1929 C.D. 172, 388 O.G. 279 which states :

' In order to be given patentable weight, a functional recitation must be expressed as a " means" for performing a specified function, as set forth in 35 USC 112, 6th paragraph '

Applicants' next contention w.r.t claim 1 that Dai does not include parts of then nano tube that are not covered by PMMA is wrong.

Dai in fig. 6 (reproduced below) shows the horizontal portions (i.e. some what parallel to x-axis) is termed " as grown mat sample" i.e not covered by PMMA which portion can be nor p or abmipolar.



In view of the above and newly applied Shim reference claims 1 and 23 are not allowable.

Claims 9 and 24 were alleged to be allowable over Dai Gardner and Buckley, however the present rejection is over Dai and Shim and therefore Applicants' arguments are moot.

Therefore all pending claims are rejected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEVEN H. RAO whose telephone number is (571)272-1718. The examiner can normally be reached on 8.30-5.30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1714. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Steven H Rao/
Examiner, Art Unit 2814